Comments on hearing answers on approval of acquisition of 3D seismic, Pitu, Capricorn Greenland Exploration 1 Limited

07-07-2011

English

Response to NERI Comments

Ref	NERI's Comments	Capricorn/ERM Response	Amendment to EIA where applicable
N1	First of all, a discrete narwhal population has a critical summer habitat in Melville Bay, making these waters very sensitive to sound emitting marine activities when the whales are present. The narwhal protection area in the bay (cf. the NERI Guidelines to seismic surveys) is designated because of the presence of these whales.	Understood.	None
	NERI requests in order to improve the assessment of impacts on the narwhal population:		
N2	- that a desktop modelling study of the directional properties of sound propagation around the array should be provided to assess the potential distances that narwhals may be impacted. Cairn very likely has this already.	PGS provided Capricorn with the results of their study *"Near Surface Attenuation of Air Gun Array Amplitudes by the Source Ghost"*, PGS January 2011. Directivity plots for a 4,135 in^3 energy source show that the SPL (dB re 1μPa at 1m) is around 30 dB down at 90º. Directivity is taken into account as the data used for predicting ranges includes consideration of measurements of an airgun array (from established literature sources), which is likely to have similar directional characteristics.	None
N3	- that source energy levels (SEL) also are indicated in the unit: dB re 1 mPa2*s	This is technically correct and has been accepted. However, the SEL criteria have not been used in the assessment which is based on the behavioural effects which relate to the rms noise levels, and not SEL.	The inclusion of the potential effects on hearing is discussed in response to specific comments below.
	NERI requests that in order to minimise impacts from the survey on the narwhal		

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	population:		
N4	- the 3D seismic survey should be carried out from mid-August,	Capricorn plans to undertake 3D Seismic Survey in the period between mid August to end September.	Survey period amended throughout
N5	- the source level of the air gun array shall be reduced, compared to what is described in the application and the EIA, to below 249 dB re 1µPa peak-peak,	The specified source level is equivalent to that of a high resolution shallow geophysical source with limited penetration capabilities. As the choice of source is determined by the geophysical objectives and geological environment, such reduction will defy the purpose of the 3D seismic survey.	None
N6	- the possibilities for applying baffles on the air guns are investigated in order to attenuate the lateral sound propagation from the air guns, as this seems a feasible way to reduce impacts from future seismic surveys in similar vulnerable areas,	Marine sources proposed for the 3D seismic survey are already designed to maximise energy output in the vertical direction and further attenuation of the horizontal propagation is currently not feasible.	None
N7	- the JNCC (2010)- and NERI-guidelines must be strictly adhered to.	Capricorn is committed to fully comply with JNCC and NERI Guidelines.	None
N8	In addition to these points, NERI will suggest that a sound study is carried out in relation to the survey. This study shall document the sound propagation in different directions and distances from the survey area when the survey takes place. This should be done using acoustic dataloggers that are deployed before onset of the seismic activity.	In 2010 Cairn carried out an extensive marine sound / noise study. The project was logistically demanding and as a consequence far exceeded the original budget. Whereas in principle marine sound propagation research could add valuable insights into better understanding the effects on marine mammal behaviour, we would suggest that any such study should be funded from the contributions made under the environmental licence commitments and be undertaken as a wider JIP. In this respect Cairn has already provided results from proprietary modelling studies undertaken by PGS on horizontal sound	None

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		wave propagation from an air gun array similar to that to be used for the Pitu 3D seismic survey. Directivity plots for the proposed source show the attenuation of the wavefield from the vertical for the in-line and cross line directions. The study shows that the received levels (dB re 1 µPa) are in the range of 150 dB reducing to 120 dB 90º from the vertical at a distance of 500 m from the source. Levels for other distances can be calculated assuming spherical spreading. Deployment / recovery of real-time dataloggers before /after the acquisition period in the Pitu area is not a viable option as it would significantly complicate field operations and increase ship traffic in the region beyond the already short field operations window. In any case such study would by definition be confined to ground-truthing the noise levels as derived by modelling and would provide no information on the TTS (Temporary Threshold Shift) or PTS (Permanent Threshold Shift) effects or behavioural responses relating to marine mammals.	
	NERI has a number of comments to the EIA-report.		
N9	First of all we wonder why we have to repeat comments from previous ERM EIAs?		
	The following are the most critical points of critique:		
N10	- there is a lack of evaluation on whether the present biological knowledge is sufficient for an EIA analysis. The EIA should state clearly that the knowledge base especially regarding many marine mammals is limited for the survey area, making it difficult to conclude on effects on seismic surveys.	Marine mammal data for the project area have been taken from NERI documents, predominantly the Kanumas West SEIA, which is highlighted by BMP as being an "important source of information when preparing the EIA reports". This document provides a tabular summary of marine mammal occurrence in the study area,	In response to this comment ERM has added clarification that data gaps do exist

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		which has been used to inform the assessment. ERM has based the assessment on available data.	and that uncertainty is taken into account when assessing the effects of seismic activities on marine mammals. However, given the data presented in the Kanumas West SEIA and method of assessment (by hearing group), the conclusions of the assessment remain valid for any animals that may be affected.
N11	- there is no founded discussion or argumentation for why the very high source level is needed or a discussion on alternatives based on relevant literature.	The choice of source is largely determined by the geophysical objectives and geological environment. Imaging depth requirements (≈17,000m) necessitated the use of a relatively large source for Pitu 3D seismic survey.	None
N12	- there is no mentioning of the special Arctic transmission properties in marine waters.	This has been noted in some studies. However, the zones on which the assessment is based take into account measurements of seismic surveys in cold	None

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		seas, and therefore sound attenuation rates are expected to be typical of the rates for this sort of environment. Acoustic waveguide effects can form in the upper layers of the water as a result of stratification and ice cover. However, the seismic survey will be carried out during ice free conditions, and as noted above the energy from seismic survey equipment is directed downwards, which is unlikely to make this layer significant in terms of airgun noise propagation.	
N13	- there is no regard to the fact that seals have a lower threshold for temporary and permanent threshold shifts than whales.	This was not the focus of the study as the most significant effects are likely to be behavioural effects on agglomerations of Narwhal, and the migrating whales.	A paragraph has been added to the EIA to recognise that this is the case.
N14	- it is neither mentioned nor considered that it has been recommended that there is no seismic activity in the period 15 July to 25 October in the narwhale summer protection area, despite that the noise from the seismic survey extends to and overlaps with this protection area at levels known to cause behavioural reactions in narwhales when exposed to icebreaker noise.	NERI report 785, which outlines the protection zones, indicates seismic activities shall be avoided or of limited extent within Zone I between 1st June to 15th October. The northernmost Pitu 3D survey area is located at least 50km south of protection zone. Given current ice conditions at the survey location, the survey is likely to be conducted between mid August and end of September, well outside the narwhale zone II protection period from 15th October to 1st December.	Survey period amended throughout
N15	- dB is not referenced correctly (i.e. rms (with duration), peak or peak-peak).	Noted for correction. Also, reference to the SPL of 261 dB re1µPa@1m (peak-peak) (filtered at 3-128Hz) had been replaced with the peak sound pressure relating to the unfiltered signature, i.e. 90 bar-m = 259 dB re1µPa@1m, (peak). Note that the	Amended throughout

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		source level is also presented in terms of the peak pressure level as the more relevant metric for pulse sources, according to Southall et al (2007).	
N16	- there not sufficient use of up-to-date primary literature.	ERM has used updated / new literature provided by NERI and GINR and conducted further desk based research where deemed necessary. As per recommendation by BMP guidelines and by NERI the regional SEIA was an important document in compiling the EIA. The SEIA has also been highlighted by NERI as containing up-to-date information. Information from primary references is not normally considered necessary for an EIA, which is not intended to be a scientific reference document.	None
N17	- the assumptions and calculations leading to stated effected areas are not documented, e.g. conversion from peak-peak to rms.	The basis of the calculations has been added to an annex for technical readers.	See Annex D
N18	All maps should preferably include the project area for easy assessment of importance.	The project area and area of operations had been clearly indicated on all maps generated for the Pitu permitting documentation. Externally sourced maps do not always allow such modifications.	None
	Specific comments:		
	Application (BMP 3D-seismic Application_Pitu_2011.pdf)		
N19	p. 20 3.2.4.1. Pre-survey NERIs guidelines for seismic surveys (Boertmann et al. 2010) are not mentioned, despite they are to be used.	Noted. "Pre-survey" section of the application is focused on the roles and responsibilities of Capricorn/PGS prior to the commencement of the survey operations. NERI Guidelines will be used and complied with during the survey.	None
N20	p. 21 3.2.4.2. Again NERIs guidelines should have been mentioned here.	Noted.	Reference to JNCC Guidelines

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			will be replaced with reference to NERI Guidelines.
	Project plan (Project plan.pdf)		
	p. 26.		
N21	point 2) Should be JNCC and NERI…	Noted	Corrections to be made
N22	point 8) Exchange should with must.	Noted	Corrections to be made
	EIA (PEIA)		
N23	The EIA constantly refers to Western Greenland, where it should only be focused on the Pitu block. This makes it difficult to evaluate whether the information is related to the entire coastline or the Pitu block?	Much of the data presented in source reports is relevant to a large area in West Greenland, such as wind or currents data.	The use of 'Western Greenland' has been reviewed and updated to be more specific where possible, especially in the biological section of the baseline chapter.
N24	Despite thorough corrections to the last ERM PEIA regarding seismic activity, ERM still does not reference dB correctly – this demonstrates a lack of appropriate knowledge for making an EIA regarding acoustics such as seismic survey.	ERM recognises it has not referenced dB fully in all circumstances and this has been updated in the EIA for clarity. This does not affect the outcome of the assessment.	Amended throughout

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N25	p. 4-12. Irrelevant information on Polynyas, which is a winter phenomenon.	Polynyas are important features and habitats that support and attract many species during winter and spring.	ERM recognises Polynyas are predominantly a winter features and has updated the EIA to reflect this.
N26	p. 4-20-21. There are no references to stated facts about hearing in fish. The only references are to reports and not primary literature.	Information from primary references is not normally considered necessary for an EIA, which is not intended to be a scientific reference document.	None
N27	p. 4-21. Winter information about birds.	This section contains only very limited information about birds in winter and seeks to highlight destinations after the autumn migration.	Winter information has been removed.
N28	p. 4-37. Table 4.5 There is no use of this table.	This table has been generated in response to the BMP EIA guidelines. It lists VECs in northwest Greenland and shows where they have been discussed in the EIA. This tabulated approach has been adopted to avoid duplication with other sections.	None
N29	p. 4-40 to 4-43 Commercial Fisheries. The entire chapter is irrelevant.	It is recognised that fisheries off the Northwest coast of Greenland are less significant than the areas further south. However, as described by Boertmann *et al*. (DRAFT 2011) Greenland halibut and northern prawn are the main commercially exploited species within eastern Baffin Bay, accounting for 18% and 1% of the total Greenland catch, respectively, showing a significant catch is made in Baffin Bay including some offshore areas. Additionally, to assess impacts to	None

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		commercial fisheries the baseline conditions must be described.	
N30	p. 4-46 "However, as bowhead whales are protected by Greenland legislation these quotas have not been used." -This is wrong. Bowheads are hunted in Greenland and it is legal.	Noted.	Correction made.
N31	p. 4-47. Table 4.7 is not up-to-date. Only goes to 2007.	Newer information was not available at the time of writing. However, since release of the EIA updated figures have been made available.	Data up to 2009 has now been included.
N32	p. 4-49 Sustainability of Renewable Resources -Very strange chapter, and is it relevant? What is a collection of a species?	Noted.	Section deleted.
N33	p. 4-51. Why is a chapter on socio-economics at all important in an Environmental Impact Assessment? Such is the theme of SIA's.	A separate SIA is not required, nor would it be warranted for vessel based activities. The consideration of potential impacts on socio-economic receptors is therefore considered in the EIA, in accordance with normal practices. Given the relative importance of hunting and fishing to the Greenlandic people ERM has described these activities in the baseline in order to complete the assessment of potential impacts.	None
N34	p. 5-1. Will the timing depend on the 3D-survey in Saqqamiut or the ice conditions in Pitu?	The timing of the Pitu survey to a large extent will be determined by progress on the Saqqamiut survey. Ice conditions are currently preventing access to Pitu. Seismic activity can only proceed in suitably ice free conditions.	Survey period amended throughout
N35	p. 5-4. As pointed out in previous ERM EIAs all dB values must be stated to either rms (with duration), peak or peak-peak.	Noted.	Corrections made.

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N36	p. 5-5. Table 5.1 As pointed out in previous ERM EIAs all dB values must be stated to either rms (with duration), peak or peak-peak.	Noted.	Corrections made.
N37	p. 5-13. Again dB is used without proper reference value! This has been noted for earlier ERM EIAs.	Noted.	Corrections made.
N38	p. 6-2. Please provide the calculations and considerations leading to the finally chosen source level? There is no discussion or validation of why the source level needs to be this high.	The choice of source is largely determined by the geophysical objectives and geological environment, i.e.: imaging depth, sub-surface energy attenuation/absorption, etc. The Pitu survey has deep events that need to be adequately imaged if the workings of any hydro-carbon system are to be fully understood and in this respect penetration to around 17,000 m depth is required.	None
N39	p. 7-3. As noted for previous ERM EIA specify frequency content and source level for all sound sources used during the survey.	The echo sounder described in the impact assessment chapter is a single beam echo sounder for navigation and safety and is not considered part of the survey. This type of equipment is standard on many vessels. As an echo sounder uses short pulses of sound that are highly focused beneath the vessel, the likelihood of repeated exposure by a marine mammal is highly unlikely and potential impacts on marine mammals are not considered to warrant further assessment. This is in accordance with the conclusions of the USGS Report (Haley et al., (2010), "*Environmental Assessment for a marine geophysical survey of parts of the Arctic Ocean, August–September 2010*": U.S. Geological Survey Open-File Report 2010-1117, version 2.0, 251 p. [h ttp://pubs.usgs.gov/of/2010/1117/]), whereby the director of NOAA's Office of Ocean Exploration and Research deemed that the use of the echo sounder would not	The statement on echo sounders has been removed from the impact assessment chapter.

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		have significant impacts on marine mammals of a direct or cumulative nature.	
N40	p. 7-3. Seems strange to include a chapter on how to describe noise when you don't comply with your own guidelines either before or in the following chapters.	Noted.	Corrections made in line with other comments
N41	p. 7-4. Regarding "The units of measurement have been considered when comparing data from different studies in this assessment." How did you make these conversions? Please provide the calculations with assumptions in future assessments.	The basis of the calculations has been added to an annex for technical readers. References have been provided explaining the conversion factors that have been used.	See Annex D
N42	p. 7-4. The provided source level is not correct. According to Cairn the source level is 261 dB re 1 Pa peak-peak, and not peak.	Source data from Cairn has been provided which confirms that the source term filtered between (3-128 Hz) was 261 dB re 1 µPa peak-peak, and not peak. The report will be updated to reflect this. However, since predicted zones of behavioural disturbance are based on adjustment of empirically verified zones and not predictions based on this source level, the overall findings of the PEIA will not be affected.	Amended
N43	p. 7-4. The chapter evaluating the possible injury effects on marine mammals is very superficial and wrong. Before concluding on marine mammals in general, provide maximum threshold limits for all marine mammals where limits exists and not the general guidelines for cetaceans from Southall et al.2007: The injury limits for seals and harbour porpoises are much lower, and seals have not even been considered here. Secondly, the highest source level in the near field of the array corresponds to the source level of the highest individual airgun – here a source level of 249 dB re 1 Pa (peak-peak), which	Each airgun within the array produces underwater sound at peak levels of typically 220 to 230 dB re.1 µPa @ 1 m. The high level sound field required for seismic surveying is achieved by the superposition of the acoustic energy from multiple airgun emissions in a carefully controlled firing sequence. Hence, although far far-field measurements of airgun array noise indicate peak source levels from typically 240 to 265 dB re.1 µPa @ 1 m, actual sound levels close to the array are likely to be considerably lower and dominated by the noise from individual airguns. The focus of sound energy downwards also needs to be	See comments below for specific details on harbour porpoise research.

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	is much above the injury criteria proposed by Southall et al. 2007 and this means that both cetaceans and pinnipids may experience hearing injury when close to the array, however for harbour porpoises this range extends to the far field (see threshold below). The conclusions are therefore wrong in the PEIA.	taken into account and is discussed above. The focus of this assessment has been on behavioural reactions rather than hearing damage. Whilst an individual cetacean or pinniped might risk hearing damage if it remained close to the air gun, the assessment has been based on the premise that individuals are unlikely to stay close enough to the noise source for this to happen. Given the mitigation measures in place to avoid injury to marine mammals, such as soft start and MMSOs, injury is considered unlikely and the conclusions of the EIA remain valid.	
N44	-When making reflections about received levels provide calculations, references and assumptions, and use up-to-date primary literature.	We have referenced the data in the Southall and Fisheries Hydro Acoustics Working Group as these represent the combined views of international experts and have been accepted in several projects. These sources have become well established references in the underwater noise community. We have also used guidance from NMFS, which is current advice from a major regulatory body and which was adopted following a review of the available literature by an internationally recognised expert in the field. Whilst new research is emerging all the time, the study that is referred to is based on tests on one individual in a caged setting and has not formally been used to update the work of Southall *et al*.	None
N45	p. 7-6. Table 7.2. 1) Again dB is used without correct reference. And here in the defined thresholds. Provide the correct reference (peak, peak-peak or rms (with duration).	Noted.	Corrections made in line with other comments

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	This has been corrected in previous EIAs from ERM.		
N46	2) Why are seals and walruses not included?	Seals and walrus are discussed separately following the table. However, for walrus we have noted that there are few criteria available. We have made the assumption that they are unlikely to be more sensitive than the species above.	None
N47	p. 7-6. The entire chapter on harbour porpoises is wrong. Lucke et al. 2009 clearly showed that harbour porpoises experience temporary threshold shift (TTS) from airgun noise already at received levels of 200 dB re 1 Pa (p-p), and that they show aversion to the sound and changes in behaviour at received levels of 174 dB re 1 Pa (p-p). And this is despite that the primary energy in airgun noise is at frequencies much below what porpoises utilise and where they hear best. Besides, recordings of airgun noise have demonstrated that there is energy at much higher frequencies than stipulated here (Goold & Coates, 2006). The conclusion is therefore also wrong. Porpoises are likely to stay far away from the airgun array, and their distribution and behaviour is very likely to be affected.	Whilst Lucke *et al*. (2009) is potentially a useful starting point for possible updates to the Southall *et al*. data base it is noted that the behaviour response experiments are subject to some uncertainty and is based on a test of a single individual under captive conditions. It is stated that "It also remains questionable whether or not the level of 174 dB peak-peak re 1 µPa pressure or a SEL of 145 dB re 1 µPa2 s can be applied as threshold limit for behavioural reactions to impulsive sounds in harbour porpoises in general as Eigil (the test animal) was rewarded for tolerating the intense sound exposures and reactions might occur even at lower levels. It seems more likely that this limit varies individually and may be context-specific." Furthermore, the observation at received noise levels below 174 dB was actually that no behavioural reaction occurred. This suggests that whilst 174 dB might represent the onset of behavioural disturbance it is unlikely to represent the level at which significant behavioural effect would occur. The purpose of this EIA is to identify significant effects, which is the basis for the selection of studies showing level 6 reactions as defined in Southall *et al*. and the NMFS criterion (level B harassment).	Pg 7-6 and 7-7 amended

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		Using the conversion factors used in this assessment the difference between peak to peak and rms levels would be 16 dB. This would result in an equivalent rms threshold of 174 – 16 dB (ie 158 dB rms re 1 µPa). This is comparable with the NMFS criterion of 160 dB rms re 1 µPa that has been adopted in this assessment. In our view adopting this criterion for harbour porpoise would lead to a precautionary assessment in terms of likely behavioural assessment, although we accept that this study could be used to justify a change the wording of the section on harbour porpoise to show that a behavioural result might occur. The section has been adjusted to take this into account, but recognises the uncertainties involved. In terms of potential damage, however, the work of Lucke *et al*. seems to confirm that it is unlikely that animals would remain in areas where noise is sufficiently high to lead to damage, which reinforces the approach in this assessment which assumes that damage is unlikely with the mitigation measures that will be adopted. We will however, reference this work in the discussion regarding potential damage.	
N48	p. 7-7. The chapter on mid-and low-frequency cetaceans is very superficial. It is straight forward to estimate minimum received levels at different ranges from the airgun array and compare these with table	The focus of the study is on behavioural effects and this is considered for all the key species. Further calculations of distances at which different effects such as temporary and permanent threshold shifts would occur would be misleading as they would have to be calculated assuming that the animals were at arbitrary locations given the uncertainty regarding the avoidance reaction that would take place.	None
N49	7.2. This is here done assuming spherical spreading and an appropriate absorption	The calculated ranges have been based on real measurements of similar survey	A reference to the typical

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	coefficient for airgun noise (Though keep in mind that the transmission properties in the Arctic may cause noise to be at higher levels for longer time than in other areas – hence the minimum ranges). Doing this tells you that at any given point on the transect lines, the airgun noise could cause the animals to leave the area at ranges of min 100 km for baleen whales assuming the values in table 7.2 are p-p values. This corresponds to areas of min. 31,416 km2 around each shot point on the transect line. The PEIA does not take account of how far the low frequency airgun noise travels and that the received levels outside the survey area itself are above levels where behavioural reactions are expected. It is thus in a much larger area that low- mid- and high frequencies can be expected o react. We do not agree that the risk is moderate.	procedures. We believe that this gives a more realistic estimate of the potential noise impact zones than the large zones that would be calculated using this simplified spreading procedure. Such an approach would also not take into account the directivity of the air gun noise source.	distances has been inserted.
N50	p. 7-7. No knowledge does not equal no effect. The PEIA has not considered the sound pressure level thresholds at which pinnipids experience TTS or PTS, and the PEIA therefore does not have the means to conclude that the expected effects are negligible for pinnipids. As commented above the PEIA should have included the specific threshold for pinnipids.	The focus of the study is on the zones over which noise will result in a significant behavioural reaction. The zones over which TTS and PTS will occur will be smaller than these, and we have assumed that animals will not come close enough to the survey vessel to experience either TTS or PTS once seismic operation have started. Mitigation measures have been specified to ensure appropriate separation distances prior to the start of works.	None
N51	p. 7-7. "In order to be conservative, a cautious assessment criterion of 180 dB re 1 µPa (rms) has been assumed for all species in this assessment." - A threshold of 180 dB re 1 µPa (rms) is not conservative, when it is known that	It is conservative in terms of the range proposed by NMFS ie 180 to 190 dB. These are not reaction thresholds but are there to protect the animals. Separate behavioural reaction thresholds have been proposed. Given the temporary nature of the activity it is considered that this is a reasonable	None

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	bowheads, belugas and narwhales react to noise levels already around 90-130 dB re 1 □Pa (rms), and considering that the noise extends to and overlaps with the summer protection area for narwhales that are critically endangered.	approach to the assessment.	
N52	- It is not explained very clearly how this is being implemented in the assessment. No calculations have been provided to account for the conversion from rms to p-p.	The basis of the calculations has been added to an annex for technical readers.	See Annex D
N53	p. 7-7 to 7-8. "Based on this review, and taking account of the fact that the duration of the Pitu Block 3D-seismic is expected to be only 35 days in total it is likely that adopting the standards suggested by the data in Southall et al (1) would result in an unnecessarily onerous assessment of the likely effects of the operations." -There is no reason not to perform these assessments. The thresholds build on empirical data.	Whilst the thresholds build on empirical data the review specifically for seismic source undertaken for the USGS (Haley et al*.,* (2010)) suggested that the criteria adopted in this assessment are sufficiently stringent to adequately assess the effects.	None
N54	p. 7-8. "Based on the above sources a behavioural criterion of 160 dB SPL (rms) has been adopted for this assessment for the most stringent behavioural guidance levels set by the NMFS." - It is not well explained how this is used.	This is used to assess the potential for significant behavioural effects of the seismic source on cetaceans and pinnipeds including the potential for an effect on the Narwhal summering area.	None
N55	p. 7-8. "The effect on other animals in the region eg Ursus maritimus (polar bears) and Odobenus rosmarus (walrus) is not expected to be higher than those listed above." -What does this expectation build on?	We are not aware of specific research that suggests that these species would be more sensitive than other marine mammals. If there is evidence, that we are not aware of that this is the case, then we would be pleased to consider its use.	None
N56	p. 7-8. "Interim criteria of 206 dB re 1 µPa (peak) have been set with accumulated sound exposure level (SEL) of 187 dB and	As stated in the section the second of the criteria relates to fish weighing less than 2 g. The first of the SEL criteria relates to	None

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	183 dB." - What are the two different SEL criteria and what do they build on?	other fish (ie those weighing 2g or more). The background for the development is a wide body of research detailed in the references given in this section.	
N57	p. 7-8. "An adjustment has been made to account for the expected difference in noise levels (1 dB) which indicates that the zones from the larger air gun array would be a factor of 1.25 larger than the measured distances." - Provide reference for the 1 dB difference between a 3147 in3 array and a 4135 in3 array. You must know the source level of both arrays so why the assumption of 1 dB?	We have adjusted the zones that were measured in the exercise that was referenced in this document to account for a difference in air gun volume. The source levels at 1 m can be presented in different forms, and extensive validation might be necessary to check that the two figures for source terms have been presented in the same way. We therefore took the view that since the differences were likely to be small it would be more robust to make an adjustment based on volume rather than comparing source terms. The reference for the change in source term with volume is to be presented in the annex.	See Annex D
N58	p. 7-9. "… the measured levels suggest that the 4135 in3 air gun array would be expected to give a noise level of 120 dB at approximately 112 km from the source." - Is this rms or p-p? Provide equation for the calculation.	This detail will be added to the annex. The estimate of distance is based on the measurements in the Chukchi Sea.	See Annex D
N59	p. 7-10. "The source level from the seismic source will have decayed to 190 dB re 1 µPa (rms) at approximately 0.5 km, and the equivalent peak level would be approximately 10 dB higher than this (ie 200 dB re 1 µPa (peak))." - So this means that the airgun source level should be 245 dB re 1 □Pa (rms)? How do you account for that? And over what duration is rms calculated or measured?	The derivation of this figure is amplified in the Annex which will be produced. It is based on measurements and derived radii in Annex 4.1 of the report on which the predictions are based. These radii are precautionary and the effects of aspect dependence mean that a source level cannot simply be implied in the way that is suggested. Rms is calculated over the duration of a	See Annex D

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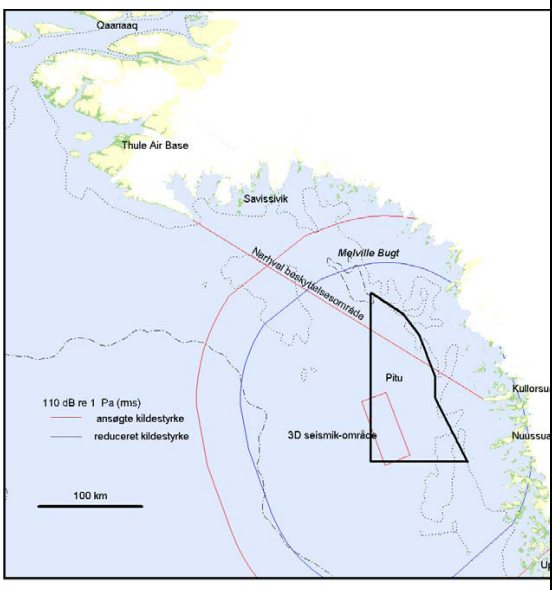
		pulse.	
N60	p. 7-11. Regarding MMOs: Marine mammal observers must search for all marine mammals during the pre-shooting search and during ramp-up, not only whales. Observations of any marine mammal within the safety zone during pre-shooting search or ramp-up leads to delay of start-up until the animal has left the area and 20 minutes has passed since last observation within the zone. - During normal shooting the MMOs will search for both seabirds and marine mammals and keep a log of all observations, not only whales.	Noted. The wording used in EIA is direct copy-paste from NERI's Technical Report 785 (2010), which specifies: • A Marine Mammal and Seabird Observer (MMSO) shall be posted on the source vessel (where the airguns are deployed from) and be continuously on the look out particularly for whales during the preshooting search and when airguns are operated.	None
N61	p. 7-11. Regarding the pre-shooting search, and hence start up: It can only be performed at good visibility and sea state below 3. This means that the pre-shooting search can not be performed in darkness, fog or sea states above 3.	Capricorn is committed to fully comply with JNCC and NERI Guidelines. JNCC refer to use of PAM as best practice for start during hours of darkness and low visibility. Whilst it is recognised that there are limitations on the use of PAM with respect to range and bearing of targets which may be further compromised by ambient noise levels, the use of PAM, along with other mitigation measures, is under consideration by Capricorn.	None
N62	p. 7-11. NERI does not agree on the conclusions for cetaceans, pinnipids or fish. Effects to a species clearly do not depend on its economical value. With regards to cetaceans and seals see various comments above. The mitigation measures only mitigate the risk for hearing damage at start up for cetaceans, pinnipids and fish, but do not mitigate damage to fish eggs. The mitigation measures do not mitigate behavioural changes in marine mammals such as masking or fleeing, and does not	ERM adopted a well established impact assessment methodology, which has been explained above and in the assessment document. As described by the methodology in Chapter 3 of the EIA, the residual impact is a function of the importance/value of the receptor and the magnitude of the impact after mitigation. Economic value to stakeholders is only one factor used to define the importance/value of the resource. For further details see chapter 3.	None

Ref	NERI's Comments	Capricorn/ERM Response	Amendment to EIA where applicable
	mitigate the high source level and therefore the long ranges with increased background noise level. NERI finds that the risk for negative impacts is high for all cetaceans and pinnipids and that the knowledge on fish hearing and reactions to noise generally is too low to make a proper assessment.	The most significant commercial species in the region is the Greenland halibut, which spawn in south Davis Strait and then eggs/ larvae then drift with the currents. Given that the survey area is not an important spawning area and only limited water affected population effects, if any, are considered to be very limited (Boertmann *et al*., 2009). Mitigation measures adopted for this project are in accordance with NERI and JNCC guidelines.	
N63	p. 7-20. Marine mammals have been found covered in oil. Clearly an animal ascending from a dive will not necessarily be able to avoid oil.	In some circumstances marine mammals are not able to avoid spills when surfacing, for example in ice covered waters. However, the survey requires ice free waters and so a spill would not occur in these circumstances. The potential for spills during 3D seismic survey is very limited - max spill is the volume of fuel tank of the largest survey vessel and, thus, very similar to any other vessel operating in the area. Taking into account risk mitigation measures adopted by the project (incl. comprehensive bunkering procedures) a spill is unlikely. However, this statement has been altered to reflect more information in the Kanumas West SEIA.	Pg 7-20 amended
N63	p. 7-24. "Marine mammals and some seabirds have a moderate value due to their protection status". - What does this mean?	In accordance with the methodology described in the EIA, marine mammals and seabirds have high to medium importance/value due to their protection status and, in combination with small to medium magnitude of a potential spill, the significance of potential impact is assessed as being moderate. For further details see	None

Ref	NERI's Comments	Capricorn/ERM Response	Amendment to EIA where applicable
		chapter 3.	
N65	p. 7-24. There is simply no data to assess cumulative effects from seismic airgun noise to marine mammals. It is however known, that dolphin fecundity and calf survival decrease as a result of cumulative and long term exposure to whale watching activities, which should raise a flag for cautiousness regarding cumulative effects from seismic activity which is of much higher source level and can been heard over very wide ranges, rather than stating that it will not be a problem.	The section on cumulative impacts seeks to highlight where and how cumulative impacts may occur and to outline what changes may be expected.	None
N66	p. 8-2. The UK guidelines must be the updated JNCC version from 2009.	The most recent version of the JNCC guidelines are the 2010 guidelines.	References to the 2010 guidelines have been made throughout the chapter.
N67	p. 8-3. Regarding 8.3.1 Standards and Controls. - It must be the 2009 JNCC guidelines	See response above.	As above
N68	p. 8-4. "Seismic operations should aim to use the lowest practicable power levels throughout the survey and also to minimise unnecessary shooting, for example through extended gun tests or repeated acquisition during periods of high background noise." -There is no discussion on lowering the suggested source level or argumentation as to why it has to be so high. -There is no description on how they will measure the background noise level, which isn't trivial.	The choice of source is largely determined by the geophysical objectives and geological environment. Imaging depth requirements (≈17,000 m) necessitated the use of a relatively large source for Pitu 3D seismic survey. Background noise (typically weather related) present a challenge to any seismic operation and are reduced by avoiding operating in sub-optimal conditions and by carefully selecting hardware design, tow depth and speed, and signal processing.	None

Ref	NERI's Comments	Capricorn/ERM Response	Amendment to EIA where applicable
N69	p. 8-5. Again it shall be the 2009 JNCC guidelines.	See response above regarding the guidelines.	As above
N70	p. 8-8. NERI does not agree with the conclusions for marine mammals (see above).	The EIA does not contain page 8-8. However, conclusions are presented in Chapter 9. The conclusions of the EIA are in agreement with the Kanumas West impact assessment of seismic noise on narwhal and are more conservative than the Kanumas West assessment for other mid and low frequency cetaceans.	None
N71	**Figure 1.** The claimed area which is planned 3D seismic and the zones within which there will be an influence of sound> 110 dB 1 □ Pa (rms). The red border, with air guns that have the source strength in this application, and the blue with a reduced source strength similar to that which the U.S. rules specify. Note that even with the reduced source strength, an important part of the Conservation Area is significantly affected.  	ERM disagrees that significant effects are likely from seismic noise at a noise level of 110 dB rms re 1 µPa. ERM has presented a review of the available data relating to the response of marine mammals in Section 7.3.1 pages 7-4 to 7-8 of the PEIA. It was concluded that 160 dB re 1 µPa (rms) was sufficient to indicate the onset of significant behavioural disturbance. These levels are predicted to be generated approximately 12 km from the seismic source, which is a much smaller zone than is shown in Figure 1. Given that the nearest edge of the sensitive areas for narwhal are approximately 50 km from the seismic survey, significant behavioural reactions are not expected.	None

Response to GINR

	Greenland Institute of Natural Resources:	Capricorn/ERM Response	Amendment to EIA where applicable
	Potential impact – whales		
GI1	The air gun array that Capricorn Greenland would like to use operates with a higher output level than the 2D seismic surveys normally used in Greenland. The higher output level would mean an increased effect on the marine mammals and fish sensitive to acoustic energy.	Capricorn used the same source (i.e. 4,135 in^3) in 2008, 2009 and 2010 in connection with offshore seismic exploration. The source is also broadly consistent with that used by TGS in Baffin Bay (4,100 in^3) in 2010 and significantly less than the source used by ExxonMobil (6,500 in^3) in Disco West in 2008.	None
GI2	The target frequency specified by Capricorn Greenland is 3 to 128 Hz. Baleen whales produce sounds of 14 Hz – 24 KHz and are likely to be affected by the survey. Bowhead whales migrate through the area on their way from West Greenland to Arctic Canada as the ice breaks up from May to July (Heide-Jørgensen and Laidre 2010), and this migration is likely to be disturbed by the proposed survey. The presence of other baleen whales in the area is poorly understood.	Given current ice conditions at the survey location the survey is likely to be conducted between mid August to end September, after the bowhead migration period.	Survey period amended throughout
GI3	Field recordings of air guns with low target frequencies have shown that energy at higher frequencies can be produced as a by-product (Madsen, Johnson et al. 2006). Thus, the actual frequency range of the proposed survey is likely to be higher than the specified 3 to 128 Hz. If this is the case, the proposed survey can also disturb toothed whales that use higher frequencies, such as narwhals and belugas. Both narwhals and belugas migrate through the proposed survey area at the time suggested in the application, and may thus be affected during their migrations.	The max frequency content for deep seismic exploration is of the order of 128 Hz and it is usual to quantify output and frequency over the 0-128 Hz range. It is also usual to quantify output over the range as determined by the recording filters which is usually of the order 3-200Hz (depending on filter settings).	None

	Greenland Institute of Natural Resources:	Capricorn/ERM Response	Amendment to EIA where applicable
GI4	The exact timing and path of the spring migration of belugas from their wintering area in West Greenland to their summer grounds in Arctic Canada are not known. However, it is very likely that the migration takes place during May-July and that the migration route overlaps with the proposed survey area (Heide-Jørgensen 2010).	Current ice conditions prevent access to the Pitu Survey area. However, it is expected that the survey operations will be possible in the period between mid August to end September, thus well outside the specified migration period.	Survey period amended throughout
GI5	The survey overlaps with the migration route of narwhals from the Melville Bay population. A substantial part of the knowledge about the movements of narwhals in Melville Bay comes from 10 animals tagged with satellite transmitters in August 2006 and 2007 (Heide-Jørgensen 2010). These animals remained close to the glaciers in the coastal parts of Melville bay during August and September and during October and November moved south and southwest through a wide migration corridor to wintering grounds in Southern Baffin Bay and West Greenland. One whale tagged in Melville Bay in August 2007 returned to the bay in July in 2008, where it crossed the offshore parts of Melville Bay in May-June.	Noted. This reference was used in the EIA. Current ice conditions prevent access to the Pitu Survey area. However, it is expected that the survey operations will be possible in the period between mid August to end September, thus well outside the narwhal zone II protection period from 15th October to 1st December. The northernmost Pitu 3D survey area is located at least 50 km south of protection zone I.	Survey period amended throughout
GI6	In addition, two narwhals tagged in Uummannaq in November 2008 and 2009 moved north along the West Greenland coast in April before turning west in the offshore part of Melville Bay in May. The tagging data in concert with the data on seasonal timing of catches indicate that the offshore parts of Melville Bay are used extensively by narwhals (and belugas) moving to their summering areas both inside Melville Bay but also in the Canadian High Arctic.	Noted. The migration period referred to in Heide-Jørgensen (2010) is outside the timing of the project. It is recognised that seismic activity during migration season may interfere with migration, however, this is unlikely due to ice cover in the survey area and the revised timing of the survey (mid August to end September).	Survey period amended throughout

	Greenland Institute of Natural Resources:	Capricorn/ERM Response	Amendment to EIA where applicable
GI7	A seismic survey during June, when the amount of open water is limited can have a higher impact on marine mammals than a survey later on the summer, for example in August, when the animals have more freedom of movement and can avoid the area without risk of being trapped on ice.	Noted. Capricorn plans to undertake 3D Seismic Survey in the period between mid August to end September.	Survey period amended throughout
	Potential impact – harvest		
GI8	The catch is regulated by quotas that are considered sustainable (Heide-Jorgensen and Ugarte 2009). Hunter's reports delivered to the Ministry of Fisheries, Hunting and Agriculture show that narwhals are caught in coastal waters of Melville Bay from early July to early October. In 2009, catches from Upernavik took place from July 14 to August 12 (n=63 narwhals), with Tuttulissuaq as the most important hunting ground. In Savissivik in 2009, the first narwhal was caught in July 9 and the last on August 12 (n=23 narwhals).	Noted.	Comment on sustainability added.
GI9	The narwhal hunt is needed for the subsistence of several families in northern Upernavik and Savissivik. The catch is often planned in advance and hunters travel to the hunting grounds by dinghies and settle in temporary summer camps. Narwhals are then caught from kayaks using hand held harpoons.	Noted.	None
GI10	A survey before mid July could potentially disrupt the pattern of arrival of narwhals to the hunting grounds, affecting the outcome of the hunt and compromising the planning of hunting expeditions.	Noted. Capricorn plans to undertake 3D Seismic Survey in the period between mid August to end September, thus well outside the narwhal zone II protection period from 15th October to 1st December. The northernmost Pitu 3D survey area is located at least 50 km south of protection zone I.	Survey period amended throughout
	Existing regulations		

	Greenland Institute of Natural Resources:	Capricorn/ERM Response	Amendment to EIA where applicable
GI11	NERI has recommended a protection zone for the migration of Melville bay narwhals during fall from the summer grounds in Melville Bay to the winter grounds in Baffin Bay and West Greenland (Boertmann, Mosbech et al. 2009). This protection zone is being reviewed in the light of new data. The migration corridor should be much wider than at present, and the period when no seismic surveys are allowed in the migration corridors should be extended to include both the southbound migration from summer to winter grounds in October-December and the spring migration from the winter grounds in Baffin Bay and West Greenland to the summering area in Melville Bay and Arctic Canada during May - July.	Noted. ERM will update any future submissions with new information as it becomes available. ERM would like to receive the new report once it is available.	None
	Mitigation measures		
GI12	We recommend that the seismic survey from Capricorn Greenland should be carried out during August or September. This timing would protect narwhals, belugas and bowhead whales during their northbound migrations in the spring and early summer, as well as narwhals and belugas during their southbound migrations in the fall.	Noted. Capricorn plans to undertake 3D Seismic Survey in the period between mid August to end September.	Survey period amended throughout
GI13	In addition, Capricorn Greenland should seriously consider reducing the source level of the airguns used in the proposed seismic survey.	The deep exploration objectives of the Pitu survey require adequate source power level to enable proper seismic imaging of the subsurface thus ensuring the survey objectives will be met.	None
GI14	Finally, Capricorn Greenland should consider shortening the duration of the survey to less than the proposed 33 days.	The 3D survey duration cannot be reduced from the nominal estimated unless the scope of work is reduced. The survey dimension in the in-line direction however has been maximised to minimise source time.	None

	Greenland Institute of Natural Resources:	Capricorn/ERM Response	Amendment to EIA where applicable
	Lack of information		
GI15	To better understand and assess the effect of the proposed seismic survey on toothed whales, the applicant should supply data on the effective frequency output of the air guns. If this data is not available, suitable sound recordings should be made on the field to use as reference material when evaluating the effect of similar surveys in the future.	A study on the effects on odontocetes from the proposed seismic survey by remote measurement of the frequency content of noise levels would be meaningless without a study of the TTS (Temporary Threshold Shift) or PTS (Permanent Threshold Shift) effects and behavioural responses undertaken concurrent with the remote measurement. A plot of the unfiltered frequency spectrum of the source array used in the Pitu 3D seismic survey has been provided to BMP. The graph shows a peak amplitude in the 10 – 80 Hz range (at around 217 dB absolute) which is more or less ideal for exploration surveys. At 250 Hz the response is ca. 15 dB down on peak amplitude and at 500 Hz ca. 30 dB down.	None

Response to NNPLAN

Ref	NNPAN (Department for Interior matters, Nature and Environment)	Response	Amendment to EIA where applicable
NN1	In the section regarding the Greenland whale and the beluga whale on page 7-6 it is stated “However, the survey is planned to start between June and August and so noise from the seismic survey will not occur for at least half of the migration period.”NNPAN believes that even though the species are only present some of the time in the area, it is still a problem, that the wild life risk being disturbed by the seismic acquisition.	Noted. Capricorn plans to undertake 3D Seismic Survey in the period between mid August to end September.	Survey period amended throughout
NN2	The same remark goes for page 7-9; ”The migratory routes of whales through the area in June would only be affected for (at most) half of the migration season and then only if the survey started in June.”	Noted. Capricorn plans to undertake 3D Seismic Survey in the period between mid August to end September.	Survey period amended throughout

Response to ICC

Ref.	*Comment*	*Response*	*Amendment to EIA where applicable*
ICC1	ICC suggest a minimum of 6 weeks' hearing deadline for all future public hearings	This is a matter for the Government of Greenland	None
ICC2	ICC is gravely concerned about the company's request for seismic exploration late June till August, depending on the local ice situation, and the possible, negative consequences of exploration during this period	It is anticipated that the 3D Seismic Survey will be undertaken during the period between mid August to end September. This timing will assist in protecting narwhals, belugas and bowhead whales during their northbound migration in the spring and early summer, as well as narwhals and belugas during their southbound migration in the autumn. Shooting of seismic will follow the JNCC and NERI Guidance for such noise generating activities and this includes provision of two Marine Mammal and Seabird Observers and start-up requirements.	None
ICC3	They refer to information from NERI that 3D seismic may have negative effects on baleen whales and, according to GINR, also on toothed whales. This is particularly serious if it coincides with whale migration or when whales are on their breeding grounds. According to GINR Greenland whale, beluga and narwhal migrate through the area and stay there mainly in May – June. Seismic acquisition in this period will negatively influence the whales and the catch of local hunters.	See ICC2	None
ICC4	ICC want to apply a principle of prudence on such a vulnerable area	See ICC2	None

Ref.	*Comment*	*Response*	*Amendment to EIA where applicable*
ICC5	ICC support the proposal from GINR to postpone seismic acquisition till August or September. Cairn should check whether possible to reduce airgun sound intensity and whether possible to shorten duration from the planned 33 days (alternatively use two seasons, depending on ice situation)	The specified source power level is equivalent to that of a high resolution shallow geophysical source with limited penetration capabilities conducted elsewhere (e.g. in the Davies Strait) and to 2D acquisition in Baffin Bay carried out by other third parties. The airgun choice is determined by the geophysical objectives and geological environment. Marine sources proposed for the 3D seismic survey are already designed to maximise energy output in the vertical direction and further attenuation of the horizontal propagation is currently not feasible. See also ICC2	None

Response to GA

Ref.	Comment	Response	Amendment to EIA where applicable
GA1	The Employers Association has no comments	Thank you for responding to the public hearing	None

Response to Qaasuitsup

Ref.	Comment	Response	Amendment to EIA where applicable
QAA1	The hearing period is way too short and should be extended to 8 weeks or more. It has not been possible to handle the EIA politically, due to the short hearing deadline. Furthermore, it has not been possible to involve local settlements. The comments are prepared by the Municipality's environmental section. Comments from politicians or local communities will be forwarded.	This is a matter for the Government of Greenland	None
QAA2	To give opportunities for influence, the hearing material should be forwarded much earlier, to make it possible to implement changes based of hearing comments	Capricorn is committed to following the Guidelines and will forward information as prescribed by such Guidelines	None
QAA3	QM is pleased that drilling hearing comment are public and suggest the same for seismic hearing	This is a matter for the Government of Greenland	None
QAA4	Possibilities for use of local manpower or services should be explored	There are few realistic opportunities for provision of manpower locally or services as activities are specialist, short-term and relatively self-contained. Crew changes and re-provisioning will occur through our existing port services and it is not practical to relocate activities for such short periods and taking into account the logistics required for personnel transfer. However, Capricorn is happy to consider local services and capabilities in future activities.	None

Ref.	Comment	Response	Amendment to EIA where applicable
QAA5	QM find it important that local communities are informed. They want to know whether Cairn has conducted public meetings in Upernavik, Savissivik and Kullorsuaq as part of the EIA. They want access to minutes from such meetings, without reference to individuals	No public meetings were held in relation to the 3D seismic EIA works. This was not a requirement of the Guidelines when the work was carried out.	None
QAA6	QM suggest that non-technical summary be sent to the service centres of the communities that could be affected, i.e. Upernavik, Qaanaaq, Kullorsuaq, Savissivik etc. QM also suggest to use local radio and other media	Capricorn has followed the EIA Guidelines and this was not a specific requirement. All EIA documents are available on the government website and Capricorn will be happy to provide copies of the NTS locally	None
QAA7	QM has local insight, but no relevant professional competence on seismic. They strongly suggest that experts from GINR and NERI carefully evaluate whether negative effects are minimized as far as possible and whether there is an acceptable level of effects on wildlife, fishing and hunting. QM want to get confirmation that the short hearing deadline has not negatively influenced GINR's and NERI's evaluation of the EIA	Capricorn has submitted all suitable information in support of the work to the BMP and their advisors in accordance with the Guidelines. Capricorn is responding to all questions submitted as part of the EIA submission and public hearing process including all questions from technical advisors to the BMP.	None
QAA8	QM wants to know whether 3D noise level is higher than what has been the case in previous seismic campaigns. The non technical summary should elaborate more on effects of noise on wildlife. Cairn should document that the noise level has been reduced to the lowest level possible	The specified source level is equivalent to that of a high resolution shallow geophysical source with limited penetration capabilities conducted elsewhere (e.g. in the Davies Strait) and to 2D acquisition in Baffin Bay in the last few years. The airgun choice is determined by the geophysical objectives and geological environment. Marine sources proposed for the 3D seismic survey are already designed to maximise energy output in the vertical direction and further attenuation of the horizontal propagation is currently not	None

Ref.	Comment	Response	Amendment to EIA where applicable
		feasible.	
QAA9	Due consideration should be taken towards wildlife. The Melville Bay is protected. Inhabitants of Upernavik and Savissivik are often in or near Melville Bay on hunting of narwhal. Narwhal hunting takes place from early summer till beginning of autumn and is regulated by quotas. QM want to know whether seismic will influence hunting and whether cumulative effects of seismic and hunting have been considered. Fishing and hunting is the livelihood of some of the families in the local settlements; therefore due consideration should be taken to wildlife and hunting. Hunters should get compensation if it appears that there are negative effects on hunting	It is anticipated that the 3D Seismic Survey will be undertaken during the period between mid August to end September. This timing will assist in protecting narwhals, belugas and bowhead whales during their northbound migration in the spring and early summer, as well as narwhals and belugas during their southbound migration in the autumn. Acquisition of seismic will follow the JNCC and NERI Guidance for such noise generating activities. This includes provision of two Marine Mammal and Seabird Observers and start-up requirements.	None
QAA10	It is important that seismic acquisition takes place when it has minimum negative effect on wildlife. QM wants to know whether it has been checked that the proposed period, June – August id the one that will have the least, negative consequences on local wildlife and on transport and use of the area	See QAA9	None

Response to Semersooq

Ref.	Comment	Response	Amendment to EIA where applicable
SER1	Due to short hearing deadline, potential comments from the political handling will be forwarded later on. The short deadline will negatively influence real public involvement	This is a matter for the Government of Greenland	None
SER2	The seismic acquisition takes place in an important area for several whale species and in the close proximity to the Melville Bay Protection Area. GINR has informed that there is migration of narwhal, beluga and Greenland whale in the application area in the period applied for. GINR has recommended that acquisition is carried out late August till September to minimize effects on hunting of narwhal and beluga. Also the duration should be limited. KS support GINR's view and suggestions	It is anticipated that the 3D Seismic Survey will be undertaken during the period between mid August to end September. This timing will assist in protecting narwhals, belugas and bowhead whales during their northbound migration in the spring and early summer, as well as narwhals and belugas during their southbound migrations in the autumn. Reference should be made to the detailed response to NERI/GINR.	None
SER3	The hearing material says that there is hunting of minke whale, but no quota hunting of narwhal, beluga and Greenland whale. The hearing material lacks evaluation of effects on hunting for the local population.	In Greenland normally hunting and fishing activities would be covered in a separate SIA but this is not required, nor would it be warranted for vessel based activities. However, consideration of potential impacts on socio-economic receptors is therefore considered in the EIA, in accordance with normal practices elsewhere. Given the relative importance of hunting and fishing to the Greenlandic people ERM has described these activities in the baseline in order to complete the assessment of potential impacts.	None

Ref.	Comment	Response	Amendment to EIA where applicable
SER4	KS support that there are 2 MMO's onboard. They lack explanation at which distance from marine mammals acquisition will be stopped, and regulations and description of general procedures	Capricorn is committed to fully comply with JNCC and NERI Guidelines and will retain two MMSOs on board. Procedures are laid out in the JNCC and NERI Guidelines.	None

Response to Ministry of Fisheries

Ref.	Comment	Response	Amendment to EIA where applicable
MOF1	The Melville Bay is an important area for a number of hunted species. MF is particularly concerned about narwhal, beluga and Greenland whale. This is an important summer feeding area for narwhal and it is during this period narwhal hunting takes place. Summer hunting is a very important source of income for many hunters, who otherwise have few alternative sources. MF is of the opinion that any disturbance of the narwhal population in the Melville Bay during the planned period, is unacceptable. MJ is also concerned about disturbance of migration of beluga and Greenland whale.	It is anticipated that the 3D Seismic Survey will be undertaken during the period between mid August to end September. This timing will assist in protecting narwhals, belugas and bowhead whales during their northbound migration in the spring and early summer, as well as narwhals and belugas during their southbound migrations in the autumn.	None
MOF2	(Fig 1, Overview of catch of narwhal in the settlements Savissivik, Nuussuaq and Kullorsuaq, 2007-2009)	Noted	None
MOF3	MF support the hearing comments of GINR sent on 7 June 2011	Capricorn acknowledges this point and reference should be made to the NERI/GINR response to the comments.	None

Response to SIK

Ref.	Comment	Response	Amendment to EIA where applicable
SIK1	SIK demands that the application on 3D is rejected, since (according to them) part of the license is within a protected area. They refer to the area's unique importance as a migration and breeding area for beluga and narwhal. SIK see seismic acquisition as a breach of the protected status of the area	NERI report 785, which outlines the protection zones (plus recently updated data from KANUMAS West preliminary strategic environmental impact assessment), indicates seismic activities shall be avoided or of limited extent within Zone I during summer months due to the Narwhal summering area. The northernmost Pitu 3D survey area is located at least 50km south of the designated protection zone. It is anticipated that the 3D Seismic Survey will be undertaken during the period between mid August to end September. This timing will assist in protecting narwhals, belugas and bowhead whales during their northbound migration in the spring and early summer, as well as narwhals and belugas during their southbound migration in the autumn. Shooting of seismic will follow the JNCC and NERI Guidance for such noise generating activities and this includes provision of two Marine Mammal and Seabird Observers and start-up requirements.	None
SIK2	They regret the short hearing deadline. Public hearing normally has considerably longer deadlines SIK infer that, due to the short hearing deadline, the GL Government de facto already has given Cairn the go-ahead on this exploration activity	This is a matter for the Government of Greenland	None
SIK3	SIK ask Cairn to minimize the use of Icelandic and Faeroese support vessels, when similar, GL vessels are available	There are few realistic opportunities for provision of manpower or vessels locally with respect to supporting the seismic operation. Crews experienced in the support of multi streamer seismic	None

Ref.	Comment	Response	Amendment to EIA where applicable
		operations are necessary to ensure the safety and integrity of the operation. In addition vessels need to be adequately insured to the levels and are required to undergo safety audits in accordance with IMCA /CMID guidelines and have in place a working SMS. However, Capricorn is happy to recommend local services, and vessels which meet the requirements for provision of support services, to the seismic contractor for consideration	
SIK4	SIK ask the Government to learn from the current hearing. It should be possible for GL language speakers to understand and study the hearing documentation	This is a matter for the Government of Greenland.	None

Response to Kanukoka

Ref.	Comment	Response	Amendment to EIA where applicable
KAN1	KANUKOKA thank you for the hearing material related to Capricorn Greenland Exploration 1 Ltd.'s activities in South Greenland and have the following, general comments.	Thank you for your comments	None
KAN2	KANUKOKA remarks that the short hearing deadline makes it difficult to assess and gather information from citizens and specialists on the hearing material and will, therefore, recommend that the hearing deadline on future hearings be set to 8 weeks.	This is a matter for the Government of Greenland	None required
KAN3	KANUKOKA has noted that the planned seismic activities overlap in time with the hunting season in the area and, thus, will have a cumulative effect on wildlife and disturb hunting. KANUKOKA will therefore propose that seismic acquisition only starts ultimo August.	It is anticipated that the 3D Seismic Survey will be undertaken during the period between mid August to end September. This timing will assist in protecting narwhals, belugas and bowhead whales during their northbound migration in the spring and early summer, as well as narwhals and belugas during their southbound migrations in the autumn.	None required